

## CLAIMS

1. A process for the chemical vapor deposition of silicon nitride on a substrate using a hydrazinosilane of the formula:



where each  $R^1$  is independently selected from alkyl groups of  $C_1$  to  $C_6$ ; each  $R^2$  is independently selected from the group consisting of hydrogen, alkyl, vinyl, allyl, and phenyl; and  $n = 1-4$ .

10 2. The process of Claim 1 wherein the hydrazinosilane is selected from the group consisting of: Bis(1,1-dimethylhydrazino)methylsilane, Tris(1,1-dimethylhydrazino)silane, Tris(1,1-dimethylhydrazino)-t-butylsilane, Tris(1,1-dimethylhydrazino)s-butylsilane, Tris(1,1-dimethylhydrazino)ethylsilane, Bis(1,1-dimethylhydrazino)ethylsilane, Bis(1,1-dimethylhydrazino)iso-propylsilane, Bis(1,1-dimethylhydrazino)allylsilane, Bis(1,1-dimethylhydrazino)silane, Tetrakis(1,1-dimethylhydrazino)silane, N,N',N''-Tris(dimethylamino)cyclotrisilazane, N,N',N'',N'''-Tetrakis(dimethylamino)cyclotrisilazane, Tris(1,1-dimethylhydrazino)iso-propylsilane, Tris(1,1-dimethylhydrazino)allylsilane and mixtures thereof.

20 3. The process of Claim 1 wherein the temperature of the substrate is in the range of approximately 100 to 800°C.

4. The process of Claim 1 wherein the pressure is in the range of approximately  $10^{-5}$  Torr to 760 Torr.

25 5. The process of Claim 1 wherein the hydrazinosilane is reacted with a nitrogen source selected from the group consisting of nitrogen, ammonia, hydrazine, amines, and mixtures thereof.

6. The process of Claim 5 wherein the molar ratio of ammonia to hydrazinosilane can be greater than or equal to zero.

7. The process of Claim 1 wherein the substrate is silicon.

8. The process of Claim 1 wherein the substrate is an electronic device.

9. The process of Claim 1 wherein the substrate is a flat panel display.

10. The process of Claim 1 wherein each R<sup>1</sup> is independently selected from  
5 the group consisting of methyl and ethyl and each R<sup>2</sup> is independently selected from the  
group consisting of hydrogen, methyl, ethyl, propyl, iso-propyl, n-butyl, iso-butyl, tert-  
butyl, allyl and phenyl.

11. The process of Claim 1 for the deposition of silicon nitride by chemical  
vapor deposition.

10 12. The process of Claim 1 for the deposition of silicon oxynitride by chemical  
vapor deposition.

13. The process of Claim 1 for the deposition of silicon nitride by plasma  
enhanced chemical vapor deposition.

14. The process of Claim 1 for the deposition of silicon oxide by plasma  
15 enhanced chemical vapor deposition.

15. The process of Claim 1 for the deposition of silicon oxynitride by plasma  
enhanced chemical vapor deposition.

16. The process of Claim 1 for the deposition of materials selected from the  
group consisting of silicon oxide, silicon oxynitride, and silicon nitride by atomic layer  
20 deposition.

17. A low temperature chemical vapor deposition of silicon nitride in a reaction  
zone, comprising the steps of:

a) heating a substrate to a temperature in the range of approximately 100-800°C  
25 in said zone;

b) maintaining the substrate in a vacuum at a pressure in the range of approximately  $10^{-5}$  Torr-760 Torr in said zone;

c) introducing into said zone a hydrazinosilane of the formula:

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where each  $R^1$  is independently selected from alkyl groups of  $C_1$  to  $C_6$ ; each  $R^2$  is independently selected from the group consisting of hydrogen, alkyl, allyl, and phenyl; and  $n = 1-4$ ; and

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d) maintaining the conditions of a) through c) sufficient to cause a film of silicon nitride to deposit on the substrate.

18. The process of Claim 17 wherein the hydrazinosilane is selected from the group consisting of: Bis(1,1-dimethylhydrazino)methylsilane, Tris(1,1-dimethylhydrazino)silane, Tris(1,1-dimethylhydrazino)-t-butylsilane, Tris(1,1-dimethylhydrazino)-s-butylsilane, Tris(1,1-dimethylhydrazino)ethylsilane, Bis(1,1-dimethylhydrazino)ethylsilane, Bis(1,1-dimethylhydrazino)iso-propylsilane, Bis(1,1-dimethylhydrazino)allylsilane, Bis(1,1-dimethylhydrazino)silane, Tetrakis(1,1-dimethylhydrazino)silane, N,N',N"-Tris(dimethylamino)cyclotrisilazane, N,N',N",N"'-Tetrakis(dimethylamino)cyclotrisilazane, Tris(1,1-dimethylhydrazino)iso-propylsilane, Tris(1,1-dimethylhydrazino)allylsilane and mixtures thereof.

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19. The process of Claim 17 wherein the hydrazinosilane is reacted with nitrogen source selected from the group consisting of nitrogen, ammonia hydrazine and mixtures thereof.

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20. A composition selected from the group consisting of Tris(1,1-dimethylhydrazino)silane, Tris(1,1-dimethylhydrazino)-t-butylsilane, Tris(1,1-dimethylhydrazino)-s-butylsilane, Tris(1,1-dimethylhydrazino)ethylsilane, Bis(1,1-dimethylhydrazino)-iso-propylsilane, Bis(1,1-dimethylhydrazino)allylsilane, Bis(1,1-dimethylhydrazino)silane, Tetrakis(1,1-dimethylhydrazino)silane, N,N',N"-

Tris(dimethylamino)cyclotrisilazane, N,N',N'',N'''-Tetrakis(dimethylamino)cyclotrisilazane,  
Tris(1,1-dimethylhydrazino)iso-propylsilane, and Tris(1,1-dimethylhydrazino)allylsilane.

- 5      21.      A composition comprising Tris(1,1-dimethylhydrazino)silane,.
22.      A composition comprising Tris(1,1-dimethylhydrazino)- t-butylsilane
23.      A composition comprising Tris(1,1-dimethylhydrazino)-s-butylsilane.
24.      A composition comprising Bis(1,1-dimethylhydrazino)-iso-propylsilane.
25.      A composition comprising Bis(1,1-dimethylhydrazino)allylsilane.
26.      A composition comprising Bis(1,1-dimethylhydrazino)silane.
27.      A composition comprising Tetrakis(1,1-dimethylhydrazino)silane.
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29.      A composition comprising Tris(1,1-dimethylhydrazino)-iso-propylsilane.
30.      A composition comprising Tris(1,1-dimethylhydrazino)allylsilane.

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